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Title: Acoustic Wafer Defect Detection System

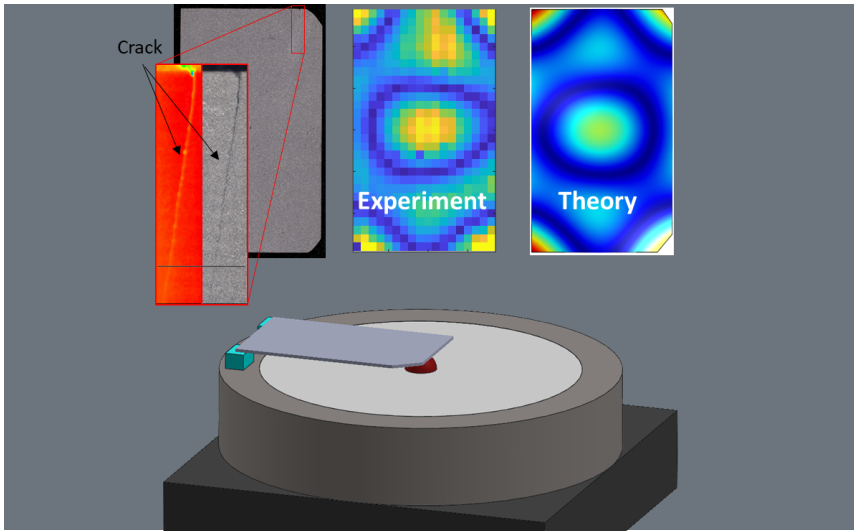
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Tech Snapshot

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ACOUSTIC WAFER DEFECT DETECTION SYSTEM



SUMMARY

Researchers at Los Alamos have developed the Acoustic Wafer Defect Detection System, a technology that enables rapid diagnosis of critical defects during wafer production. This technology is capable of both efficient and accurate detection of defects in wafers, including defects that are undetectable through current optical techniques. The system identifies the wafer defects by exciting resonant vibrations in the wafers and by exciting “crack breathing” modes. These vibrations cause the crack to periodically open and close. Specific resonance characteristics, combined with acoustic signatures resulting from crack breathing, result in a technique that is highly sensitive to cracked wafers. There are minimal custom parts used to build the system, and it can be easily implemented in nearly any wafer production plant with minimal modifications. We are seeking a commercialization partner to license the technology or partner through a Cooperative Research and Development Agreement (CRADA) to develop into a usable product for commercial purposes.



MARKET APPLICATION

This technology was initially developed to detect flaws in Bismuth Telluride wafers (thermoelectrics), but can easily be adapted to other materials, such as silicon wafers. Los Alamos would like to explore additional applications in the semiconductor, thermoelectric, and defense industries for pass/fail analysis of high-value parts and wafers. The technique is flexible enough to be used as a nondestructive evaluation tool in any industry that has parts with strict quality control requirements.

BENEFITS

This technology can provide a potential licensee or collaborator the ability to provide robust wafer quality control in their production process or portfolio. This system has the capability of speeding up wafer quality control, while ensuring maximum quality standards and keeping critically flawed wafers out of the hands of the producer's clients. This will lead to both quality control cost savings, as well as much greater product confidence and quality.

- Rapid, nondestructive wafer analysis
- High sensitivity to cracks that are imperceptible to the naked eye
- Easy implementation into a production line
- Very few custom parts required
- Adaptable to a variety of wafer types and other small structures
- Cost effective implementation

CONTACT

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WHY WE ARE BUILDING ACOUSTIC WAFER DEFECT DETECTION SYSTEM

Currently, most optical wafer inspection systems are performed by visual inspection that takes a significant amount of time, and passes a large number of wafers with critical flaws that fail during processing. This technology replaces visual inspection with a smarter technique that can sense otherwise near-invisible hairline cracks or internal defects that can cause critical failures down the line. This greatly increases product confidence and reduces losses.



WHAT'S BEHIND OUR TECHNOLOGY

Our Acoustic Wafer Defect Detection System is a novel combination of both linear and nonlinear acoustic techniques, as well as machine learning for better classification of wafers. The system works by applying a combination of low and high frequency vibrations to the wafer, and measuring the acoustic response, which includes information about the resonant vibrational modes of the wafer and signatures from any cracks in the wafer. These measurements create several statistics that provide information about the wafer. Individually, each statistic is insufficient to determine the damage state of the wafer, but combined with machine learning, it results in a high-accuracy classification system. Additionally, by continuously retraining the system with new samples in the field, the system can improve its accuracy.



OUR COMPETITIVE ADVANTAGES

Current techniques require manual inspection of wafers, which takes a considerable amount of time to diagnose wafer defects and cannot detect hairline cracks or internal defects that could result in critical failure of the final system. The Acoustic Wafer Defect Detection System is rapid, has high sensitivity to hairline cracks, and is capable of detecting other damage types (voids, inclusions, etc.) not detected through current optical techniques.



OUR TECHNOLOGY STATUS

Los Alamos has tested a full laboratory prototype on production BiTe wafers. The technology requires further research and development for industrial device packaging with a collaboration partner. We are making small improvements to get quickly to Minimum Viable Product status. At this time a potential commercialization partner could license and further develop the technology depending on the partner's capabilities. We are seeking a commercialization partner to license the technology or pursue further improvements through a CRADA.



PUBLICATIONS AND IP

Acoustics-Based Fast Noninvasive Wafer Defect Detection

Appl. No. 63/025,144, filed May 14, 2020

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